Investigation of Intermolecular Interactions in Aqueous Solutions of Non-Electrolyte Liquids: Photoacoustic and Acoustic Studies

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It is well known that, in order to recognize the microscopic nature of solutions, systematic investigations of their physico-chemical properties are necessary. In this work we would like to present experimentally obtained results on concentration dependent changes of thermal effusivity in water solutions of some organic non-electrolyte compounds. Photoacoustic open cell technique with microphone registration was applied for determination of this parameter. Examples of some simple alcohols, cyclic ethers and polyethylene glycols were studied and analyzed. Thermal effusivity is defined by square root of three parameters product: d - density, k - thermal conductivity, and c_p - specific heat of a sample. Until recently, this quantity was not considered as useful for characterization structural changes in solutions. For this reason, the investigations of effusivity changes have been compared with results obtained by us using some better established techniques. Concentration dependent changes of molecular volume and isentropic compressibility coefficient were concurrently measured and analyzed. Density and speed of ultrasound were determined with the use of vibrating tube densitometer and an automatic speedometer respectively. We would like to show that:

a) The accuracy of photoacoustic signal amplitude registration is sufficient for investigation minor changes of thermal effusivity in liquid solutions (relative uncertainty about 1 %),

b) The thermal effusivity can be successfully used as an indicator of structural changes in the liquids,

c) The information on interactions between components of the solutions obtained from the thermal effusivity results supports and complements conclusions obtained from other experimental methods and from literature data.